

FOR
THE ESTABLISHMENT OF
A SCHOOL OF ARTS.

MEMORIAL
OF THE
FRANKLIN INSTITUTE,

OF THE
STATE OF PENNSYLVANIA,

FOR THE PROMOTION OF THE MECHANIC ARTS,

TO THE

Legislature of Pennsylvania.

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MEMORIAL

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THE Managers of the "Franklin Institute of the State of Pennsylvania, for the promotion of the Mechanic Arts," desirous of enlarging the sphere of usefulness of the Institution over which they preside, solicit the attention of the Legislature to the following plan of a *School of the Arts*, designed for the thorough practical instruction of the large and important class of the community engaged in the various branches of the mechanic arts, in manufactures, and in agriculture. They are convinced that an institution of such a description, in which the mechanic, the manufacturer, the miner, the civil engineer, the farmer, the iron master, and, indeed, all engaged in the *useful arts*, would be taught the practice, combined with the principles of their respective pursuits, would supply a want which has long been painfully felt by a large portion of our citizens, and would confer upon them and upon the public extensive and lasting benefits. They are also persuaded that the present organization of the Institute, together with the numerous advantages arising out of its position and its experience, in regard to matters connected with such a plan, render it peculiarly adapted for the attainment of the objects which your memorialists have in view.

The Franklin Institute in its original organization contemplated a comprehensive system of practical instruction in the USEFUL ARTS, embracing all, or nearly all, the important objects which your memorialists propose to realize.

The actual scope of operations, though less extensive than was intended by its founders, has nevertheless been sufficiently complete to illustrate the value, as well as the practicability of a more enlarged system.

A brief statement of the exertions of the Institute, in promoting that more intimate union of science with the useful arts, which was the leading object of its founders, will, it is believed, establish for it a strong claim to encouragement from the Legislature, and the more especially so, when in connection with the history of what it has done, honourable as this is to its character, we exhibit the captivating picture of what it may do with expanded resources.

Under the direction of a *Committee on Instruction*, the Institute has sustained, since the year 1824, by regular, though insufficient salaries,

two professorships--one of chemistry, the other of natural philosophy, keeping carefully in view the application of both these branches to the mechanic and other useful arts. About a year since, another department was annexed embracing an equally detailed course of lectures on technology, or the science of the principles involved in the various operations of the several arts and manufactures. In addition to these, the Institution has furnished the public with numerous, more or less extensive courses of lectures on other branches of knowledge, having a similar tendency, contributed by persons of science who have volunteered their exertions in promoting the plans for instruction so zealously pursued by it from its infancy.

The crowded state of its lecture-room for many seasons past is, alone, a sufficient testimony of the degree in which the public appreciates the efforts of the Institution to diffuse practical instruction.

A drawing-school thronged by youths eager to possess themselves of this branch of education, so indispensable to the mechanic, has been diffusing its advantages very extensively for several years, and no feature in the whole system of the Institution has been fraught with more obviously satisfactory results.

Another feature in its system for encouraging the mechanic and other useful arts, by bringing the sciences to their assistance, and one more useful, probably, than any other in the Institution, is presented in the operations of a permanently organized "Committee on Science and the Arts." The functions of this committee, which are of a somewhat novel nature, extend to the investigation, experimentally, when necessary, of all questions appertaining to new inventions or new suggestions concerning any of the processes in the arts, besides problems involving research, or dignified by their influence, either on individual or national welfare, whether submitted by private citizens, or by the state, or general government. The proceedings of this committee which has in several instances been selected by the Government of the U. States and of this state, to examine points of importance, requiring the application of scientific research, as shown by its reports printed in the Journal of the Institute, sufficiently demonstrate its steadfast zeal for the useful arts, and the wide sphere of usefulness which the public confidence has in the short period of its exertions, about three years, caused it to occupy. By taking within its list of members a very large portion of the more able cultivators of science, and the more scientific and ingenious mechanics and practical men of the large community in which it is situated, and apportioning to suitable sub-committees the work of investigation on the innumerable inventions and queries which come before it from all sections of the Union, this committee, aided by the facilities furnished through the Institute, is performing without intermission an amount of laborious research in the service of the arts, only to be credited by those who will visit the committee-rooms and witness the almost daily sessions of the sub-committees.

From the brief exposition which has just been given of the laborious and efficient exertions of the Institute, in the various departments of instruction and investigation embraced in its present plan, it must be apparent that the large fund of useful experience acquired by those who take a share in its operations, enables them precisely to understand what

kind of practical and scientific training is most required in the plan of education proposed, and to suggest such arrangements in the details of instruction as are most likely to be attended with extensive and permanent good. In its large list of members, and among the numerous friends who have encouraged and aided its efforts, many are to be found whose personal co-operation in the details of practical instruction, connected with the enlarged organization for which your memorialists pray, would be, in the highest degree, conducive to its early and continued success. Furthermore, the high importance which has been attached to the practical labours of the Institute, even on its present limited scale of operations, and the consequently deep and active interest which it has inspired in all who have witnessed its career of laborious but quiet usefulness, give confident assurance of the cordial and efficient co-operation of the wide circle of its friends in the promotion of any plan calculated to extend its sphere of beneficial operations. To the great and permanent advantages which the Institute is thus enabled to hold out, your memorialists would add the important considerations of its being already in possession of many valuable models illustrative of useful inventions in the mechanic arts, and of a library which, for works of practical science and periodicals and other publications relating to the arts, is already of respectable extent, and which too, through the medium of exchanges with its own journal, is daily furnished with detailed accounts of every thing new in the records of scientific or mechanical invention.

Your memorialists desire to call attention to the peculiar advantages which their school of arts, if encouraged, would derive from this committee on science and the arts, the salutary influence of which in preserving alive the zeal of all who are connected with the Institute, could readily be brought to bear on the department now projected. It is easy to perceive how much solid improvement would result to both teachers and pupils by introducing into the instructions of the former, the facts and principles involved in new inventions and discoveries in the arts, which they themselves would have been previously discussing in the capacity of members of this committee. It would impart a perpetual freshness and interest to their lessons, such as no other institution could command, while the pupils, the more advanced of whom, might be permitted to attend the meetings and debates of the committee, would be unceasingly collecting through this admirable source, new facts and extended notions on their respective subjects, and be daily bringing their newly acquired lessons to the test of experiment and practice in their several workshops and laboratories. It is not difficult to foresee that a school of practical instruction, so assisted would, itself, very soon become the birth place of valuable discoveries in the arts, so that the state, if in no other way, might look to the solid benefits thus arising to its citizens as a tenfold compensation for all that the proposed School of Arts can cost it.

While alluding to the advantages offered by the Institute in promotion of the plan in view, your memorialists refer with peculiar satisfaction to the invaluable facilities for practical instruction in the arts arising from its location near the largest city of the state, surrounded by workshops and manufactories of every description, for the most part under the personal direction of its members, who are daily carrying into practice the useful lessons received within its walls. To the stu-

dent of practical science and the arts, the opportunities thus afforded of becoming conversant with the details of the subjects to which he is devoting his attention, are of incalculable importance; and indeed, without such opportunities, it is manifest that his knowledge must remain vague and incomplete. Thus happily situated, the Institute possesses capacities of usefulness to which, under no other circumstances, it could lay claim. Every workshop, laboratory, mill, and manufacturing establishment in the city and its neighbourhood would contribute to its means of instruction and become incorporated in the general plan, by which useful and practical knowledge is to be taught, and thus the Institute, in the enlarged character to which it aspires and comprehending the additional resources here adverted to, would present the grand and gratifying spectacle of one vast *university*, for the cultivation of practical knowledge, where every useful art would receive the combined illustrations of the lecture-room for its principles, and the workshop for its manual details.

Invoking your liberality to enable them to carry into effect a plan which promises such great benefits to those who have engaged in the practice of the useful arts, and to the whole state, your memorialists respectfully solicit your attention to the following plan of organization, which they here present with the view of enabling you to estimate the probable amount of appropriation which will be necessary, as well as more distinctly to understand the important objects they have at heart.

P L A N

OF INSTRUCTION PROPOSED FOR THE

S C H O O L O F A R T S

OF THE

FRANKLIN INSTITUTE.

The subjects of instruction might be divided into six great departments as enumerated below, each under the superintendence of a professor, whose duty it should be to teach, by lectures and recitations, in as much practical detail as possible, the scientific principles connected with the department of which he has charge. To each department should be attached sub-professors or practical instructors, more or less numerous as the case may require, among whom should be divided the duties of giving instructions in the details of the various arts embraced in the department. In the more strictly practical branch of the department, the student should be introduced to the workshop, the laboratory, and the field; should be taught the use of tools or instruments of the art he is studying, and should have the fullest opportunity of acquiring practical dexterity and tact. With this view, workshops and laboratories of the arts, and a small farm should be provided, with the implements and furniture appropriate to each.

- 1st. Department of Mechanical Science and the Mechanic Arts.
- 2d. Department of Chemistry and the Chemical Arts.
- 3d. Department of Mathematics and the Arts connected with it.
- 4th. Department of Geology, Mineralogy, and the Art of Mining.
- 5th. Department of Civil Engineering and Architecture.
- 6th. Department of Agriculture and Rural Economy.

Under the head of Mechanic Arts, would be included the Arts of Construction generally—ironfounding, smithing, turning, the construction of engines and tools, machinery for mills, mining, and other purposes, carpentry, masonry, &c., in all of which, full instruction would be given in the workshops of the department. Connected with this, would be a department for model-making, furnished with an ample collection of models of machinery, structures, &c., which the student should be taught to imitate with his own hands.

The Chemical Arts would include the Art of Analysis in all its details as applied to minerals, soils, vegetable, or animal matters, and the

products of art; such as the manufacture of glass and porcelain, dying, bleaching, tanning, the fluxing of ores, with the construction of the various kinds of furnaces, and the manufacture of chemical substances. In the laboratories attached to this department, the student would learn all the minutiae of manipulation, by conducting experiments, and performing analyses under the direction of his teacher; in the other workshops and manufactories appertaining to the same general division he would acquire a practical knowledge of the various other arts which it embraced.

The Arts connected with the Mathematical Department would include Drawing in all its branches, the Dividing of Instruments, &c. The School for Drawing, attached to this division, being regarded as one of the most important features in the plan, would be amply provided with instructors, giving full courses of lessons in architectural and machine drawing, linear drawing in all its branches, and topographical drawing and sketching; always applying when necessary, the principles of perspective and descriptive geometry as taught in the mathematical department.

Practical Geology, Mineralogy, and the Art of Mining, would include lessons in the field to illustrate the mode of ascertaining the boundaries, thickness, and depth of strata; of determining the position and nature of their dislocations and of making accurate geological maps, and sections of mineral regions. It should also embrace practical instruction in the use of the blowpipe, with the modes of recognizing minerals, besides minute information regarding the various sorts of rock cements, together with a full account, illustrated by an ample collection of specimens of all the earthy and rocky materials used in construction, or employed in any of the arts.

Under the head of the Art of Mining, would be taught the various methods of opening and working mines, by drifts, shafts, and slopes; of propping, timbering, and ventilating mines, and of extracting, cleaning and conveying their mineral products; also, modes of tracing mineral veins and seams, and of surveying and plotting mines.

Civil Engineering would include common, field, road, and town surveying; the division of land and topographical surveying, all taught as much as possible by actual operations in the field, and requiring the student to make habitual use of the compass, chain, level, theodolite, sextant, and transit instrument. Minute attention would be given to the calculations and drawings used in laying out rail-roads and canals, and to the practical details of construction as applied to rail-roads, canals, bridges, aqueducts, macadam and common roads, together with whatever appertains to locomotive power.

Agriculture and Rural Economy would include, besides the details of general husbandry, many matters connected with chemistry and mechanics; as the analysis of soils, the construction of agricultural implements, &c.

In presenting to the consideration of the Legislature the foregoing plan of an Institution for comprehensive instruction in practical science and the arts, it is proper to remark, that the objects to which it is directed, though of the highest value, have not hitherto been embraced, at least to an important extent, in the plans of education of any of our schools or colleges. Our institutions of learning being chiefly employed in pre-

paring young men for the learned professions, have not felt the importance of adopting a system of education, which, while it embraces a full and accurate development of the principles of the physical sciences, should carry those principles out in their applications to the arts, by detailed practical lessons, and especially by actual *discipline* in the workshop. Without, therefore, presuming to detract from the usefulness of the system of education generally pursued in our higher institutions as applicable to the professions, and without designing invidious comparisons between it and the directly practical plan of instruction proposed, we feel called upon to exhibit the value of such practical education to a large portion of the community, and to show the imperious demand for it at the present time.

In the early stage of the arts, when machinery and processes were rude, simple, and imperfect, little more was necessary for practising them, than manual tact, or a knowledge of the routine of operation. The mechanic looked for no aid to science, and, indeed, science was not prepared to afford any valuable assistance. But in the advanced condition to which the arts have now attained, the utility of a knowledge of the scientific principles involved in them is generally admitted. This utility is not less marked in the daily operations connected with any of the arts, than in developing improvements in its processes, or extending the sphere of its useful applications. The discoveries and the deductions of modern science have been so liberally imparted to the arts, and have become so closely interwoven with them in every stage of their improvement, that to be an enlightened mechanic, it is also necessary, to a certain extent, to be acquainted with science; nor is it less true, that a knowledge of some of the arts is requisite to the cultivation of science itself.

Considering the mechanical and chemical arts, in which are embraced all that are most valuable to society, as the diversified applications of the principles of physical science, it is, at once obvious, that to those who are to devote themselves to any of their numerous and important subdivisions, a thorough knowledge of the doctrines of the sciences having a bearing upon them, is of the utmost utility, if it be not absolutely indispensable.

It may be regarded as rather a singular fact, that with a demand so urgent for instruction in practical science, no comprehensive plan has ever yet been organized for furnishing the mechanic with the knowledge he requires. While institutions are every where established for instructing professional men in the principles and the practice of their several callings, where is there one professing similar objects in connection with mechanical pursuits? Our higher seminaries, where alone, instruction in physical science can be obtained, even were they in general accessible to the young mechanic, could not, from their adaptation to other purposes, impart the kind of knowledge of which he chiefly stands in need. The illustrations of general laws or principles, however valuable in themselves, in order to be useful to him, require to be followed up by a series of detailed *practical lessons*; teaching not merely in a vague form the application of those principles to the arts, but actually *developing* each branch of the arts in all the minutiae of practice. His business through life will be with the details of art, and

his course of study ought to be such, as to make him master of those details, as well as of the scientific principles upon which they depend. So little has science, in this practical form, become a portion of the system of education, that it is doubtful whether any very valuable light could be obtained by the young mechanic prosecuting his studies with a practical view in any of our higher institutions, and however well versed in the languages, or in the general principles of moral and physical science, it may well be doubted, whether the young graduate of any of our colleges derives much practical benefit from his studies, when he devotes himself to the labours of the farm, the laboratory, the mine, the furnace, or the workshop.

It is chiefly in the minuter details of his calling, that the intelligent mechanic feels the necessity of scientific knowledge. If he aims to be a mechanist, it is not enough that he should be taught by models, the properties of the several mechanic powers, or that he should learn the general doctrines of motion and forces. He must be made familiar with machinery in a great variety of combinations ; must be accustomed to estimate the advantages of the minutest modifications of the parts, and must be perfectly at home in regard to every point in their construction. To this end, moreover, he must be practised in the delineation of the various forms of mechanism, so as to be prepared at any time to reduce his plans to an exact form on paper, or to take accurate copies of the models he is investigating. Is he to be a practitioner of any of the cheminal arts—a manufacturer of iron, for example ? it is not enough that he should be told that the one heated with a certain proportion of charcoal or coke, and a flux will produce the crude metal ; and that by a subsequent operation, the charcoal may be removed, and the metal converted into malleable iron. He must be taught to distinguish by appropriate means, the various kinds of ores which are in use, and to ascertain the ingredients of each ; he must be instructed in all the details of the furnace and the forge ; and must know in what way each of the processes is influenced by the nature and proportions of the materials employed, and by the form and arrangements of the furnace and the blast. Is he to be a dyer or calico printer? it is not enough that he should be made aware of the chemical effects of a few colouring substances and mordants ; but he should be taught *experimentally* the properties of all the dye-stuffs and mordants employed, and practically instructed in all the minute, but important, particulars in their application, which extensive experience and the lights of chemical science can supply. Is he to be a miner? it is not enough that he be made acquainted with the general methods of mining and exploring for mineral treasures. He should be practically instructed in the knowledge of minerals, in regard to their external characters and their composition ; should be taught where to look for them, and when found, how to obtain them abundantly and at least expense. In a word, he should be made, practically, a mineralogist ; and as such, his mining would be directed by sure principles and not by blind chance, or by a routine more often inapplicable than appropriate. Is he to be a carpenter or architect? he must be taught the principles which regulate the distribution of his ties and supports ; must know how to calculate the forces operating in each portion of his frame work or other construction ;

must be minutely conversant with the laws which regulate the strength of the various materials he employs, in all the diversified forms and attitudes in which they are introduced, and as the ground work of true excellence in his profession, he must be made expert in the delineation of works of carpentry and architecture. In fine, is he to be a cultivator of the soil? he must be instructed in the mechanics and the chemistry of his profession, as well as in the various systems of husbandry in successful use: he must be taught in the lecture-room and workshop, the peculiar qualities and the exact structure of all the various utensils employed in agriculture: he must learn in the laboratory how to ascertain the ingredients of the soil upon which he operates; and of the marl, plaster, lime, or other mineral manure which he is to apply.

Such with many other branches of instruction, of a like character, are proposed to be embraced in the plan of practical education now submitted: and who can doubt that the mechanical, manufacturing, and agricultural classes of the community would derive the highest advantages from the establishment of an institution directed by these views. With a mind stored with a knowledge of the principles as well as the details of his own and other associated branches of the arts—disciplined to careful enquiry, minute accuracy of calculation, and just modes of reasoning upon his operations—the young mechanic, artizan, or manufacturer, would enter upon his career with the sure prospect of a degree of usefulness to himself and to society, and with the gratifying certainty of securing the respect of his fellow citizens, by the extent and value of his practical knowledge, and the high dignity of the studies to which he has applied himself.

Thus trained at once in the details of science and the practice of the useful arts, the mechanic would be placed on a level in point of professional education with the lawyer and the physician. Proudly conscious that knowledge may be the companion of labour, he would be but little likely to feel humiliated by a comparison of his practical attainments with the acquirements of the pupils of any of our higher institutions of learning. Thus thoroughly prepared for practical usefulness, as well as dignified respectability in his profession, he would command that station in society, to which the high value of his exertions give him so just a claim.

In soliciting your aid in behalf of the proposed School of Arts, your memorialists are persuaded that the present condition of Pennsylvania, renders this a peculiarly auspicious period for carrying their views into effect with extensive and lasting benefits to the community. The active exertions which are now making in every quarter of the state, in the development of her resources by extensive mining operations, manufactures of various kinds, and plans of internal improvement, would seem obviously to call for the widest possible diffusion of that accurate and enlarged practical knowledge; for the want of which, labour and money are so often fruitlessly and perniciously expended. The succession of experiments, often blindly undertaken, and perhaps terminating in disaster, which has hitherto marked the progress of so many of the enterprises of our citizens in their earlier stages, have, it is true, sometimes secured the practical knowledge necessary to ultimate success: but at what a cost has it been procured, and how many have

entirely failed after all their perseverance, merely through a want of the right information to direct their efforts. Under the salutary influence of an institution, such as that proposed, how different would be the history of individual and state enterprises of the kind. The accurate practical knowledge that would be furnished to every portion of the state, through its numerous pupils trained in the principles, and skilful in the operations pertaining to their respective callings, could not fail quickly to be seen in the increased efficiency of individual exertion, and in the sure and accelerated development of the vast resources of the state.

In conclusion, your memorialists would add, that in making known their views and wishes to the Legislature at this time, they are encouraged by the consideration, that they make their appeal to the liberal and wise spirit of legislation, which has already originated the common school system of the state—a system, of which your memorialists regard the proposed plan, as but a particular development, founded upon the same principles and directed by the same views.

All which is respectfully submitted

By Order of the Board of Managers.